

Figure 1**Human LAS1 protein sequence**

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MSGSKKKKVTKAERLKLQEEEEERRLLKEEEEARLKVEKEEMERL 44
EIQRIEKEKWHRLAKDLERRNEELEELYLLERCFPEAEKQETKLLSQWKHYIQCD 102
GSPDPSVAQEMNTFISLWKEKTNETFEVIEKSKVVLNLIIEKLKFILLETPPCDLQDK 160
NIIQYQESILQLQELHLKFGVATEILLKQASTLADLDSGNMEKVIKDNVTLYVWAN 218
LKKNPRHRSVRFSETQIGFEIPRILATSDIAVRLHLHLYDHVSALHPVSTPSKEYTSA 276
VTELVKDDVKNVEKAISKEVEEESKQQERGSHLIQEEEEKVEEEQGDIEVKMSSAEFEE 334
SEAIK CEREMKVLSETVSAQAQLLLVENSSEKPDFFEDNVVDLCQFTTLGGVYHLDILE 392
LPPQCKPVKGWMIVEILKEGLQKYTPPETTEEFETENAFPPIEVTLEVHENVIFFED 450
PVVVRWDAEGKHWRTDGISNVSYKPKERLVTFSLDTFGPVTLIQDAHINMPYQSWELR 508
PLDVNKKVLLTVTTVFTEIQIQIKENLCMLSSI KLKDKKHISILEGTWMTPIPFIIALK 566
EAGLNIFPTRHSHFYVI INNKVPLVEVKAYRQWALLSSAFAGWSKWNLLCNSTKVVF 624
KVREHLTEECTENPNWALLMFGDRAQRLKIKEESEAFSEALKEETEFHSTLYHVMVKD 682
FASEEAMEKVRSSNCQFVNSVCHMLLLSTRLLSYS 716

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Figure 2**Human LAS1 gene sequence**

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1  atgtctggca gtaagaaaaa gaaagtcacc aaagctgaac gattgaagct gctacaagag
61  gaggaggaga gacgactgaa agaggaagag gaagcccgtt tgaatatga gaaagaagaa
121 atggaaggc ttgaaataga gcgaattgag aaagaaaaat ggcatcgact tgaagcaaaa
181 gatctagaaa ggagaaatga agaacttgaa gaactttatt tattagagag gtgttttcct
241 gaagcagaga aattgaaaca gaaaactaaa ttgcctttctc agtggaaagc ctacattcaa
301 tgtgatggga gtcctgatcc ttcagtagcc caagaaatga acacgtttat tagtttgtgg
361 aaagagaaaa caatgagac ttttgaggaa gtgattgaga agagtaaagt agtgctaaat
421 ttaattgaga aattgaaatt tattttactg gaaactccac catgtgattt gcaagataaa
481 aatataatag agtaccaga atcaatacta caactgcagg agctccttca tcttaaatc
541 ggtgtagcca cagaaatact tctcaaaaca gctagtactt tggcagatct ggacagtggg
601 aatatggaaa aagtcattaa agatgaaaaat gttactctgt atgtgtgggc aaacctcaag
661 aagaatccaa ggcacagaag tgttagattc tctgaaacac aaattggatt tgagattcca
721 aggatattag caacaagtga cattgctgta cgactcctgc ataccacta tgatcatgtt
781 tctgcactgc accctgttcc aacaccatca aaagaataca cttctgcagt aactgagctt
841 gtcaaaagatg atgttaagaa tgtagaaaaa gcaatcagca aggaggtcga agaagagttcc
901 aaacaacaag aaagagggtc tcacttaatt caggaggaag aaataaaagt tgaggaggaa
961 caagtgata ttgaagtga aatgagttct gctgaggaag aatctgaagc cataaaatgt

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Figure 2 (continued)**Human LAS1 gene sequence**

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1021 gaacgagaga tgaagtgatt aagtgaaact gtttcagcag cacagttgtt gctggttagag
1081 aattcttctg aaaagccaga tttctttgaa gacaatgtgg tggatttatg ccagttcaca
1141 actctgggtg gagtatacca cttggatat tggagcttc ctccacagtg taaaccagtg
1201 aagggatgga tgattgtgga aatactcaaa gaaggattac agaaatacac atatcctccg
1261 gaaactacag aagagtttga gacagaaaat gctttcccac ctatagaggt cacacttgag
1321 gttcatgaga atgtaatctt ttttgaggat cctgtggttg taaggtggga tgctgaaggt
1381 aaacattgga gaactgatgg catcagcaat gtatcctaca aacaaaaga aagacttgta
1441 acattcagcc tggacacctt tggccctgtt acctgattc aagatgctca tattaacatg
1501 ccgtaccagt catgggaact aagaccactt gatgtaata aagtactttt aactgtgact
1561 acagtattta ctgagattca aatacaaaatt aaggaaaacc tctgcatgtt atcttcaatc
1621 aaactaaaag acaagaaaca catctctatt ttggaaggaa cctggatgac tcctattcct
1681 ttcattattg ctttgaaaga agctggactg aatatcttct ctactagaca ctctcathtt
1741 tatgttatta taaacaataa gggtcccttg gtagaagtga aagcttatcg acagatggcc
1801 ctactaagtt ctgcttttgc atttggttgg agcaagtgga acctactatg taattctaca
1861 aaagtcgtat ttaagggtgag ggaacacctt actgaagaat gtactgagaa tcctaattgg
1921 gcccttttaa tgttttagtg tgacagagca caaagactga agatcaagga agagagtgag
1981 gcattttctg aagcacttaa agaagaaact gagtttcat tctactttata tcacatgggtg
2041 aaggattttg cttctgagga agcaatggag aaagtcagga gttccaactg tcagttttgtc
2101 aactctgtgt gccacatgct gctctctacc agattgctca gctactccta a

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Figure 3**Mouse Las1 protein sequence**

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MAPKSKKAPSKKKMTKAERLLRMQEEEEERRLKEEEEARLKFEKE      44
EQERLEIQRIEREKWNLLLEKKDLERRSQELEELALLEGCFFPEAEKQKREIRALAQWKH      102
YTECDGSPDPWVAQEMNTFFISLWEEKNQAFEQVMEKSKLVLSLIEKVKLLILLETPTY      160
ELDHRTVLQHQSILRLQELLSLKINVAATELLLRQASNLAADLDTGNMEKIIKDENVTL      218
YVWANLKKNPRHRSVRFSETQIGFEIPRIATSNVALRLLHTRYDHITPLFPPIAVTEQ      276
NQNPGAEQVNVVEESTEKAMTEEKLFTTEKKAANEDEQPKAEQEREINLVQEENKYEAI      334
ENTVLQRTSDSEGEDSQTTQLELEMKLLSEAVLAAQLCLVENNVVELPEASQAYKVDLC      392
HFSTLGGVYHLDVLELPPQCKPVKGWVLVEILQEGLRFIYPPDTTTEEPDPPDVTFPPI      450
EVTLEIHKSVIFFERPRVVRWDNEGKFWRSDGISSVYNNREDRLITFSMDTIGPVTLI      508
QDAHVNNMPYQSWEMSPCGMKNKVLIVKTVFMELQIYIKENLCMLASVKLRGKGLEFHL      566
K GKWMAPIPFILALKEAGLNIFPAVYSHFYVINNKVPQVELKAYRQMALSSAFSFG      624
WSKWNMVCNSTRVIRVREQLSEETEHHTWSLLMFSGDRAQMLKMQEENDKFSEALRE      682
GTEFHSTLYHMMKDFASPVAMERVRHSNCQFIDSVCMLLSIRVLSYS      730

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Figure 4**Mouse Las1 gene sequence**

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1  ttgtgagtgg gcgtggcctg tcgtcttgac aaccgtgagc gttcctgctc tgcagcgttc
61  acttttccct aagcaaaagt cctgcttctg tcatggctcc caaatcaaaa aaggctccca
121 gtaagaaaaa gatgaccaaa gccgagcgac tgcggctgat gcaggaggag gaggagagac
181 gcctgaagga ggaagaagag gcgcggctga aatttgaaaa agaagaacag gaaaggctag
241 aaatacacg gattgagaga gagaagtga atctgctgga aaagaaagac ctagaacgaa
301 gaagccaaga gcttgaagag cttgctctgc tcgagggttg tttcctgaa gcagagaaac
361 agaagcggga aattcgagct ctggctcagt ggaagcacta cacggagtgt gatgggagcc
421 ccgacccttg ggttgcccag gaaatgaaca cgttcattag cctgtgggaa gaggagaaag
481 accaggcctt tgaacaaagt atggagaaaa gcaaaactgg tctgtcgttg attgaaaaag
541 tgaagttaat tttactggaa actccgacat atgagctgga ccacaggact gtcctgcagc
601 atcaagggtc aattctgcgc ctacaagagc tgctcagcct gaagatcaac gtggccacag
661 aactacttct tcgacaagct agtaacttag cagatctgga cactgggaat atggagaaaa
721 tcatcaaaag tgagaatgtc accctgtacg tgtgggcaaa cctcaaaaag aatccaaagg
781 accggagtgt gaggttctca gagacacaaa ttggatttga aatccaaagg atcctggcca
841 cgagcaatgt tgctcttcgg cttctacaca cgcgtatga ccacatcaca cccttgttcc
901 ccattgccgt cactgagcaa aatcaaaaac ccgtgggagc agagcaagtc aacgtcgagg
961 aaagtacaga aaaggccatg actgaagaaa agctctttac tgaagaaaaa gctgccaacg
1021 aagatgagca gccaaggct gaacaggaaa gagagctcaa cttgggtcaa gaggagaaca
1081 aatatgaagc tatagagaac actgtcttac aaaggacttc cgactctgaa ggggaggatt
1141 cccaaccac ccaacttgaa ctggagatga agctgctgag tgaagcagtc ttagcagcac
1201 agctgtgcct ggtagagaat gtggtggaat tgccagaagc ctcaagacc tacaagggtg

```

Figure 4 (continued)**Mouse Las1 gene sequence**

```

1261 acttgtgcca tttctctacc ctggcgccgc tgtaccacct ggatgttctg gagctgcccc
1321 ctcagtgcaa gcctgtgaag ggctgggtgc tagtggagat actccaggaa ggactgcaga
1381 ggtttatata tcctccagac accacagagg aacctgatcc agacgtcacc ttcccaccca
1441 tagaggtcac actggagatc cacaagagcg tcatcttctt tgagcgccct aggttcgtca
1501 ggtgggacaa tgaaggtaaa ttctggcggg cagatggcat cagcagtgtc tattacaacc
1561 gagaagacag gctcctaacc ttcagtatgg atactttggg ccctgtgacc ttgattcagg
1621 atgctcacgt gaacatgcct taccagtcct gggagatgag tccctgtggc atgaacaaaag
1681 tccttctaata agtgaagacg gttttcatgg agctccagat atacatcaag gaaaacctct
1741 gcatgctggc ttcagtgaaa ctgaggggca agggactcga gtttcatcta aaaggaaaat
1801 ggatgggctcc tatacccttc attctggctt tgaagaggcg cgggctgaac atcttccctg
1861 ctgtatactc ccatttttat gtggtcatca acaataagggt accccagggt gagttgaagg
1921 cctatcggca aatggcccctg ctgagctctg ccttctcgtt tggctggagc aagtggaaaca
1981 tggctctgcaa ttccacaagg gtgtgtattc ggggtgaggga acaactgtca gaagaaaacag
2041 agcaccatac ctggtcgctc ctcatgttca gtggtgacag agcgagatg ctcaagatgc
2101 aggaagagaa cgacaagtct tcggaggccc tcaggagggg caccgagttc cactccacct
2161 tgtaccacat gatgaaggac ttcgccctccc ccgtggcaat ggagaggggtc aggcattcga
2221 actgccagtt catcgactca gtgtgctaca tgctgctgtc tatccgcgtc ctacagctatt
2281 cctagctatt cctagccctt acagcgtgtg taagcatggt ggacccttat accgagagga
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2401 actgcaaaaag gaa

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Figure 5

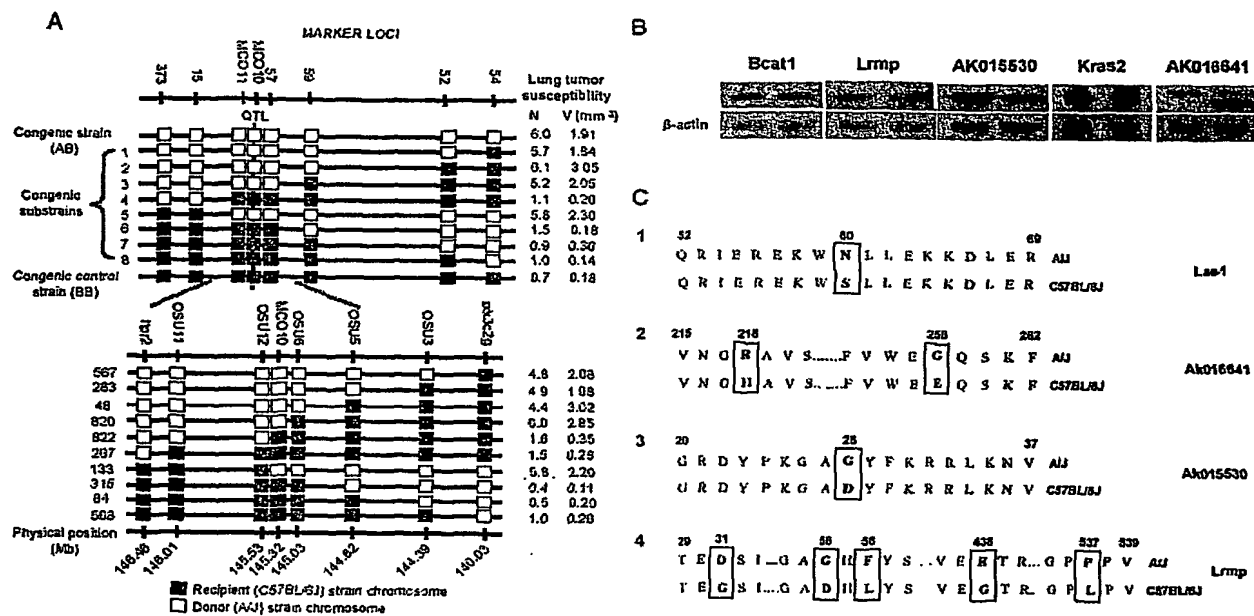


Figure 6

Mouse	MAPKSKAPSKKKKTKAERLRIMQEEEEERRLKEEEERLKEKEEERLEIQRIERREKWK	60
Human	MSSSKKKKKTKAERLRILQEEEEERRLKEEEERLKYEEERLEIQRIEKEKWH	55
Ciona intestinalis	MPFKSPNRSGKSTPTGRGPGEKKLEEKILQEEEEERLRLEEEERARQEEKAREKLEQE	58
Mouse	LLEKQDEERNQOELEELALLECCFPEARKKKEIRALAQWKHYTCDCGSPDPVVAQEMNT	120
Human	RLKAKDEERRNEEELEELVLERCFPEARKKCEITKILLSQWKHYTCDCGSPDPVVAQEMNT	115
Ciona intestinalis	RRAEIDTKKDKQWFETNIELSAVKLENEQVKNDKLAHAEWNEKMKCDGKPDPTSVREINT	118
Mouse	FISLWEEKNQAFECVMEKSKLVLSLIERVKLILLETPTTYELDHRIVLQHQGSILRLQEL	180
Human	FISLWKKKINETFEFVLEKSKVVLVLEKKEFILLLETPTTILQKMIIOYQESILRLQEL	175
Ciona intestinalis	FISLSBKSSPDVNIIVLEDAKLIISLISLIMELLEDFTEPEFECKVDSYRQILSLQEL	177
Mouse	LELKINVAEILLRQASNADLLTGNNKIKDENVTLYVWANLKNPRHRSVRFSSETQI	240
Human	LRIKFCVATNILLKQASTLADIDSGNNEKVKDENVTLYVWANLKNPRHRSVRFSSETQI	235
Ciona intestinalis	LENRYNEATLKLKKEASTADSESNLQKQVVDGENETIIMLVANLKNPRFKLFEEENEKI	237
Mouse	GFETPRILATSNVAERLLHITRYDHIITFLPLAVTEQNQNPFVGMEOVNVEESTEKAMTEEK	300
Human	GFETPKELATSDILAVRLLHITRYDHSALHPVSTESKEYTSAVTELVKDDVKN	287
Ciona intestinalis	SEELPKVLADIAVRILETKEDHYSKQCTTFLPKKKVKDEEPIPEEPKPP	289
Mouse	LFTEZKAANEDEQPKAQERELMIVQENKYEAIENTVILQRTSDEGEDSQTTQLEEMK	360
Human	--VENAISKVEVEESKQERGSLLIQEESIIVVEEJGDIEVKMSAESESEAIKQREMK	345
Ciona intestinalis	---EDAEVEVKGDEENGEDAKSVVEEGROSKQSNPEGLVNEGEKEEETKKD---ENE	341
Mouse	LISEAVAAQCLVENVVVEPEASQAYEVDLCHESLTLGGVYHLDVLELPPQCKPVKQWL	420
Human	VISETVAAQLLVENSSEPPDFZDMVVDLCQETTLGGVYHLDVLELPPQCKPVKQWI	405
Ciona intestinalis	GENEDAVKTFDVQFEIEDDEEILDPVVDLQESFLGGVYHVDLKTTPFPFNIVRGWTL	401
Mouse	VEELCEGEQRFITYPPDTT-----EPPDPDVTFPPIETVLEIHK	458
Human	VEELCEGEQKYTYPPDTT-----EETETENAFPIETVLEWHE	443
Ciona intestinalis	TQIEDKPLSTVKYPSDNPTGRSSSRVASANFEGRDEGSPSKTFLEQQCPFISITFALPS	461
Mouse	SVLEFFEPFVVRDIECKEWRSDGISVYVNFEDRLITFSMDTLCPVTILIQDAHVNMPYQ	518
Rat	MGPVTLIQDAHVNMPYQ	17
Human	NVLEFFEPVWVRDIECKHWRTDGISVSYKPKERLVTFSLDTEGCVTLIQDAHVNMPYQ	503
Ciona intestinalis	NVLEFFEPVWVRDIECKHWRTDGISVSYKPKERLVTFSLDTEGCVTLIQDAHVNMPYQ	521
Mouse	SWELSPGCKVLLIVRTWELOIYIKENLCMLASVKLSGKLEFHLKCKNMPIPIFIL	578
Rat	SWELSPGCKVLLIVRTWELOIYIKENLCMLAAVKLKCKSRELRVIGKNTPIPIFIL	77
Human	SWELSPGCKVLLIVRTWELOIYIKENLCMLSSIKLKCKKHISILEGTMTPIPIFIL	563
Ciona intestinalis	SWELSPGCKVLLIVRTWELOIYIKENLCMLSSIKLKCKKHISILEGTMTPIPIFIL	581
Mouse	ALKEAGENITPAVYSHFYVVVNNKVPQVELKAYRQMALLSSAFSGWSKWNMVCNSTRVV	638
Rat	ALKEAGENITPAVYSHFYVVVNNKVPQVELKAYRQMALLSSAFSGWSKWNMVCNSTRVV	137
Human	ALKEAGENITPAVYSHFYVVVNNKVPQVELKAYRQMALLSSAFSGWSKWNMVCNSTRVV	623
Ciona intestinalis	AMRLAGNITPAVYSHFYVVVNNKVPQVELKAYRQMALLSSAFSGWSKWNMVCNSTRVV	640
Mouse	IRVR-----EILSEE-TEHHTWSLIMFSGDRAQMLKMQEENDKFSEALRECTEFHSTLYH	692
Rat	IRVR-----EHLSEE-TEHHTWSLIMFSGDRAQMLKMQEENDKFSEALRECTEFHSTLYH	191
Human	IRVR-----EHLSEE-TEHHTWSLIMFSGDRAQMLKMQEENDKFSEALRECTEFHSTLYH	678
Ciona intestinalis	IQIAPCLIEHNVPRDAVSDDISITFSVSEDMSYKLALSEYDEEFADVVAKGATYHCLLH	700
Mouse	MMKDEASEAMERVHNSNCOFIDSVCMILLSIRVLSYS	730
Rat	MMKDEASEAMERVHNSNCOFIDSVCMILLSIRVLSYS	229
Human	MMKDEASEAMERVHNSNCOFIDSVCMILLSIRVLSYS	716
Ciona intestinalis	ACTEROPLKTATKCNWNSPKNHKTRTSFSFTRLPFY	737

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Figure 7

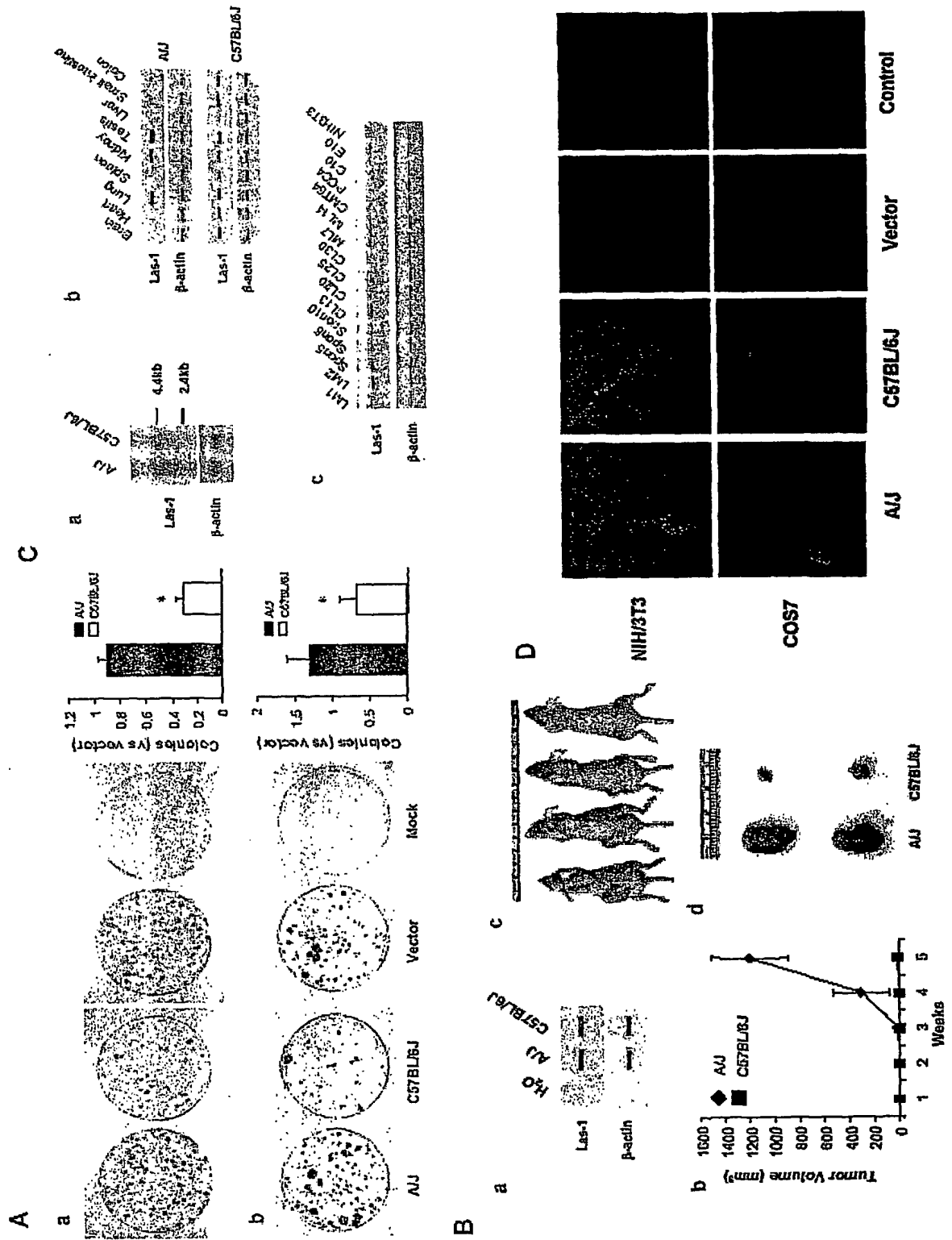


Figure 8

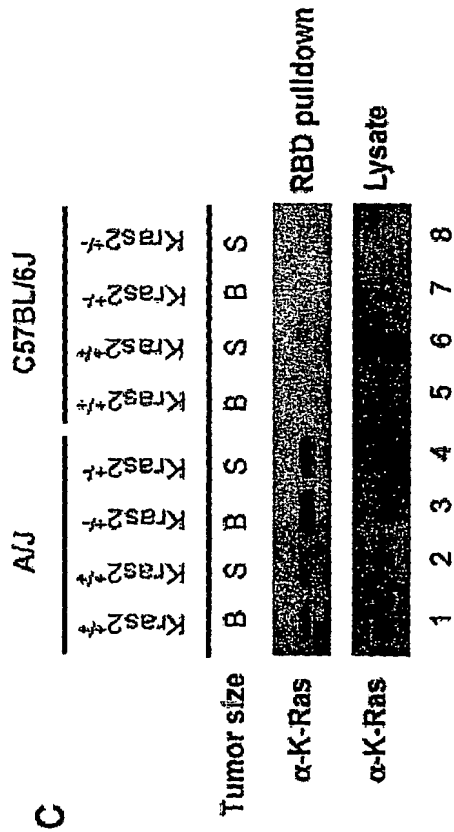
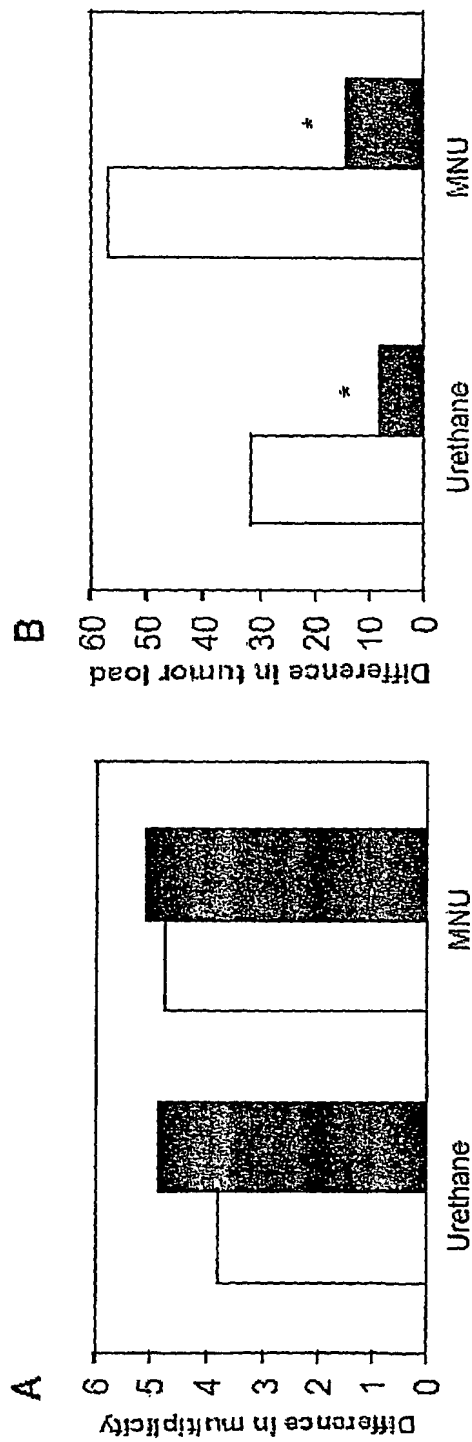


Figure 9

Table 1. All genes found in the narrowed Pas1 QTL region encompassed by marker D6OSU6 and D6OSU12

Location	Gene ID	Gene Symbol	Description	Amino acid changing polymorphisms			
				Codon	A/J	C57BL/6J	Derived from
145,053,958-145,144,990	mCG13310	Beat1	Branched chain aminotransferase 1, cytosolic	No ^a			
145,189,964-145,249,134	mCG13301	Lrmp	Lymphoid-restricted membrane protein	Codon 31	GAC	GGC	Direct sequencing
				Codon 56	GGC	GAC	
				Codon 58	TTC	TTG	
				Codon 438	AGG	GGG	
				Codon 537	CCG	CTG	
				Codon 60	AAT	AGT	Direct sequencing
145,248,888-145,257,579	mCG13308	Pas1c1					Direct sequencing
145,285,432-145,291,225	mCG13311	Ak015530 ^c	Growth hormone -inducible soluble protein	Codon 28	GGC	GAC	
145,290,331-145,324,539	mCG13312	Kras2	Kirsten rat sarcoma oncogene 2	No ^a			
145,340,836-145,341,323	mCG1027072		Similar to 40S ribosomal protein S25	ND ^b			
145,377,523-145,383,294	mCG1027183			ND ^b			
145,388,589-145,390,646	mCG1027184			ND ^b			
145,391,857-145,392,891	mCG115945		Lactate dehydrogenase pseudo gene	ND ^b			
145,403,203-145,415,908	mCG1027185			ND ^b			
145,460,150-145,460,954	mCG13304		60S ribosomal protein pseudo gene	ND ^b			
145,465,863-145,503,064	mCG13305	Ak016641 ^c	Intermediate filament-related, alternatively splicing	Codon218	CGC	CAC	Direct sequencing
				Codon258	GGA	GAA	

^aNo functional polymorphisms were identified in coding region.^bND: Not determined because any following reason: pseudogene or ribosomal protein or transcripts not detected by RT-PCR.^cAk015530 corresponds to Riken cDNA 4930469P12, Ak016641 corresponds to Riken cDNA 4933403M22.

Figure 10 Human LRP cDNA sequence

```
1  tataattggca gttattgagg gtaaagcaat atattgtaac agaattgtata aatatttttg
61  ataaaaacagt ctatatatta ttaaaaaatg aattataacc cattttcagt ttgcctgca
121  tcataagagt gagcactcca ttgctttctt tcctggccac actgctacaa tccagcacta
181  actatccatg tccagggtaa ggatcgagat cgagaagccc acactgccag tgaanaagct
241  acgtcttttac tgcataaatt agaggaagca atttcggaac aacggaacct tcaaaactata
301  aataactgaat tatcgaacac ttgccaggca cttcagcaga agacaaggaa actgaagaag
361  cttttttagat gaggaatttc ctactatga ttccctgtcc tgcgcagatg caattcaaca
421  acctcttcaa gaaaaattga agcagtgttg ccacaaacta tatggtggtc aagaagcaag
481  aatacatcag acaccctga ccttgaaaca tacgtgctgg tacacacctc tgctggatgc
541  cttatctctg gatagtttta cagcagttcc aaccctggaa tcaacacctt tctcaggtgt
601  agccaaccaa atccacactc tgtgtgaaag gccacatat ggagaagtaa aggatggtgc
661  ttgggatgta aaaagacaac acaagtgcc aggcccccaca agtggcccca gccagggaac
721  gaatctctca ggctgcatca ggatgaatga tgaccaagt atggaagaga atggtgttga
781  acgcgtgtgt cctgagagcc tgctgcagtc caggggatat tcctcactac cattaccag
```

Figure 10 (continued)

841 acacacttca tcgacagacg gtactataac ttcaagtgat cctggattag aaattctgaa
901 tatggcttct tgtgaccttg acagaaactc gctctgtaag aaagaggagg atacaagatc
961 agcttctccc acgatagagg ccaaggcac aagtcacgct catgataata ttgcattcca
1021 agactctacg agtaaggata aaaccatatt aaatctggaa gccaaaagg aaccagaaac
1081 aatagaagaa cataaaaaag aacatgcttc aggagactct gtggtttccc ctcttcctgt
1141 aaccactgtg aaatcgggta acgttagaca aagtgagaac acttctgcta atgagaagga
1201 ggtggaggca gaatttctca gattatcttt gggatttaag tgtgactgggt ttaccttgga
1261 gaagagagtg aagcttgaag agagggtccc tgactgggca gaagaaaatt tgaagaaaga
1321 aatcactaac tctttaaacc tattagagtc ttaaacacct ctgtgtgaag atgacaacca
1381 ggcacaggaa atcatthaaga agctggagaa gagtataaag tttcttagcc agtgtgcagc
1441 acgagtgccc agtagggctg agatgttggg agccatcaat caggaaaagg gggtagtaa
1501 agcagttgaa gtgatgattc agcacgtaga aaactgaag aggatgtatg ccaaagagca
1561 cgctgaatta gaagaactga aacagggtct tctgcagaat gaaagggtct tcaatcctct
1621 tgaagatgat gatgactgcc aaattaaaaa acgttcagct tctctaaact ccaagccatc

Figure 10 (continued)

1681 ttctctacga agagtgacta ttgcctcttt accagaaat attggaatg caggaatggt
1741 ggctgggatg gaaaataatg atcgattcag tagaagggtca agcagttggc gtattttggg
1801 gtcaaagcag agtgaacacc gtccctcatt acctcgattt attagcacct attcctgggc
1861 agatgctgaa gaagaaaaat gtgaactaaa aactaaagat gactcagagc catctggaga
1921 agaacagta gaaaggacaa ggaagccaag tctttctgaa aagaaaaata atccatcaaa
1981 gtgggatgtc tcttcagttt atgacacaat agcttccttg gcaacaaatc tcaagtcctc
2041 catcagaaag gctaataagg ccctctggct ctctattgca ttcatgtgtac tgtttgcagc
2101 ttgatgagc ttcctcacag gccaatattt ccagaagtct gtggatgccg ctcccacaca
2161 gcaagaggac tcatggacgt ctctagaaca tatcttgttg ccatttacca gactccgaca
2221 caatggggcca ccaccagtgt gacagcagga catcctaata tatggatctt gatttttaag
2281 tttcagtatc tgaacttcgt aaattagtaa ctttagctg ggaaagtata gcatgaaacc
2341 agaggttctc agaatgaccg taagatagct tacatttcct cttttgctt ttatctcccc
2401 aactaaaaata caatggg

Figure 11**Mouse Lrmp cDNA sequence**

```
1 aagaggtaat cctgggcctg ctgcgccgc cctgcaaac agaattgcag aagttgagcc
61 tacgcttattc atttccgtga gaagaaaagc atatttccag tttcctgtgc ctaagaacaa
121 gcatccagcg cccttcccgc ggctcaaac caggctgacc tgtgcatatg ggtcaggggg
181 atcaggatgg ggcctgcgca tgaggcaagc ctctgctaca agaactagag gaagcgattc
241 cagaaggaga tcacagtccc cagcactact cagactcagg agctgaagac caggggcgtt
301 cagtatgcct gtgtcttgac ggcctcacag caattccaag gctagaactg acacccatct
361 catgtgccag aaactcagcc catgtcttgt gtaaaaggtc cccagagca ggaaccagaa
421 gatggggcct tggacgtgac aagagggtgc cagtgccac tccccacgga aggcctccatc
481 ttgggacagg agcttctaga ctgtaccaga atgaacgagg accagagtac agacgagaat
541 ggtgctgacc acttgtattc cgagagccccg tcacagctca gggagtatct cacacagcca
601 tcgtctgaac agacttcatc ctcgagagc actgtgacgt caagtgagtc tggatcagac
661 attttgcaca tggcttcttg tgaccttgac tgcaaacctc tctgtgagaa ggaggaggaa
```

Figure 11 (continued)

721 gcaagagccg cctctgccat gcaaggcacc agcctagctc ctgctgctta tggagactac
781 acgagtgtgg gcgtgggcca ggctgcatcc cagctggaag caggagagga actcagaacc
841 acagaaaaac gaggaaggc cagtgcctcc ggagagacgg agatttccat gccccccaaa
901 gcatctgtga agctcgttaa ctttcagcag agtgaaaaa cttcagctaa tgagaaggaa
961 gtgggggcag agttcctcag gttatctttg ggacttaagt gtgactgggtt tacattggag
1021 aagaggggtga agcttgaaga gaggtcccg gacctggcag aggaaaaattt gaagaaagaa
1081 atcacaaact gtttaaagct ttagagtcg ctgactcccc tgttgaaga ggacaaccag
1141 gctcaggaaa tcgttaagaa gctggagaag agtatagtag tgctcagcca gtgcacagcc
1201 cgagtggcca gcagggtga gatgctggc gccatcaacc aggaaagccg ggtgagtaga
1261 gcggtggagg tgatgatcca gcacgtggag aacctgaagc ggatgtacgc caaagagcac
1321 gcagagctgg aggatctgaa gcaagcactg ctgcagaacg acagggtctt taactctctg
1381 ccagatgaag atgactgtca gattaaaaa cgttcatctt ctctaaattc caagccatct
1441 tctcttcgaa gagtgaccat tgcctctttg ccaggaatc ttggaaatgt ggggctggtg

Figure 11 (continued)

1501 tcaggcatgg aaaataatga cagattcagc cggcggtcga gcagctggag aatcctgggg
1561 acaaagcagg gtgagcaccg cccctcgctg catcgcttca tcagcaccta ttcctgggcc
1621 gacgctgagg acgagagaag tgacgtgaaa gccagagacg cccagaacc acaaggcgaa
1681 gaggcagtgg aggggaccag gaagcccagc ctttctgaga ggagaagtag cacattggcc
1741 tgggacaggg gcacaatctg cagctcagtg gcttcctggg tcatcacct gcaggcgtcc
1801 ttcagaagag ccaacagagc actctggctc acggggctca tcatcactat gatcgcagcg
1861 ctgatgagct tcctcacagg tcagctcttc cagacagccg tggaggctgc gccacacag
1921 gagggggact cctggctgtc tctagaacac atcttatggc catttaccag actcgtgcat
1981 gatggaccac tgccagtgtg actgacgtgc agctcaatgt acccttggat tttaacgttt
2041 ccttctgaga ttgtgaaatt ggtaactttt ttttagtaac tatagtgcaa agctagggtc
2101 ctcagcagct gggatctttt tattcccaa caaaagcaca ggggactaca aaagggaggg
2161 gacccacact aggggtatttt aatgagcttt ctgagtga ggcacagac tttattgaga
2221 tgtatccaaa taaagaccat tcaaatctta aaaaaaaaa aaa

Figure 12

Human BCAT1 cDNA sequence (coding region)

```
1  atggattgca gtaacgggac gccagagtggt accggagaag gaggatcaaa agagggtggtg
61  gggactttta aggctaaaga cctaatagtc acaccagcta ccattttaaa ggaaaaaacca
121  gacccaata atctggtttt tggaactgtg ttcacggatc atatgctgac ggtggagtggtg
181  tcctcagagt ttggatggga gaaacctcat atcaagcctc ttcagaacct gtcattgcac
241  cctggctcat cagctttgca ctatgcagtg gaattatttg aaggattgaa ggcatttcga
301  ggagtagata ataaaattcg actgtttcag ccaaacctca acatggatag aatgtatcgc
361  tctgctgtga gggcaactct gccggtattt gacaaaagaag agctcttaga gtgtattcaa
421  cagcttgtga aattggatca agaatgggtc ccataattcaa catctgctag tctgtatatc
481  cgtcctgcat tcattggaac tgagccttct cttggagtca agaagcctac caaagccctg
541  ctctttgtac tcttgagccc agtgggacct tatttttcaa gtggaacctt taatccagtg
601  tccctgtggg ccaatcccaa gtatgtaaga gcctggaaag gtggaactgg ggactgcaag
661  atggggagga attacggctc atctcttttt gcccaatgtg aagacgtaga taatgggtgt
```

Figure 12 (continued)

721 cagcagggtcc tgtgggtctta tggcagagac catcagatca ctgaagtggg aactatgaat
781 ctttttcttt actggataaa tgaagatgga gaagaagaac tggcaactcc tccactagat
841 ggcattcattc ttccaggagt gacaaggcgg tgcattcttg acctggcaca tcagtggggt
901 gaatttaagg tgtcagagag atacctcacc atggatgact tgacaacagc cctggagggg
961 aacagagtga gagagatgtt tagctctggt acagcctgtg ttgtttgccc agtttctgat
1021 atactgtaca aaggcgagac aatacacatt ccaactatgg agaattggtcc taagctggca
1081 agccgcatct tgagcaaatt aactgatatac cagtatggaa gagaagagag cgactggaca
1141 attgtgctat cctga

Figure 13**Mouse Bcat1 cDNA sequence (coding region)**

1 atgaaggact gcagtaatgg atgctccgcg ccgtttgctg gagaaagagg atcagaagaa
61 gtggcagaga ctttttagggc caaagatctc atcatcacac cagccactgt cttaaaagag
121 aagccggacc cggattcgct ggtcttttggg gctacgttta ctgaccacat gctgacggtg
181 gagtggtcct ctgcgtcttg atgggagaaa cctcacatta agccttttgg aaacttgccc
241 atacatcccc ctgcctcttgt tttgcactac gctgtggaac tgtttgaagg cttgaaagcc
301 ttttcggggag ttgataacaa gatccgattg ttccggccgg acctcaacat ggatagaatg
361 tgccgatctg ctgtgaggac cagctgccg atgtttgaca aggaggagct cctaaagtgt
421 attcttcagc ttctacagat cgaccaagaa tgggttcctt actccacctc tgccagcctc
481 tacatccgcc ccacatttat cggaactgag ccattctctg gcgtcaagaa gccttccaaa
541 gccctactct ttgtgatcct gagccccgtg ggaccttatt tttctagtgg atcttttact
601 ccggtgtccc tgtggggccaa tccaaagtac atcagagcct ggaaagggtg gactgggagac
661 tgcaagatgg gcggcaatta tggagcctcc ctcttggcac agtgcgaggc cgtggagaat

Figure 13 (continued)

721 ggctgtcagc aggtcctgtg gctgtacggc aaggacaacc agataactga agtaggcaca
781 atgaatcttt tcctctactg gataaacgaa gacggagaag aggagctggc aacgccccca
841 ctagatggca tcattctccc gggagtgacc aggcagagca tcctggagct ggcacaacag
901 tgggggtgaat ttaagggtatg tgagagacac ctacccatgg atgacctggc caccgccctt
961 gaggggaaca gagtgaagga gatgttcggc tcaggggacag cctgcgttgt ctgccagtc
1021 tctgatattc tgtacaaggg ccagatgctg catattccaa cgatggagaa tggccccaag
1081 cttgcaagtc gaatccctggg aaagctgact gatatccagt atggaagggt ggagagtgac
1141 tggacaatcg agctaccctg a

Figure 14**Human KRAS2 isoform a cDNA sequence**

```
1  ggccgcggcg gcggaggcag cagcggcggc ggcagtggcg gcggcggaagg tggcggcggc
61  tcggccagta ctcccggccc cggccatttc ggactggggag cgagcgcggc gcaggcactg
121 aaggcggcgg cggggccaga ggctcagcgg ctcccagggtg cgggagagag gcctgctgaa
181 aatgactgaa tataaacttg tggtagttgg agctggtggc gtaggcaaga gtgccttgac
241 gatacagcta attcagaatc attttgtgga cgaatatgat ccaacaatag aggattccta
301 caggaaagcaa gtagtaattg atggagaaac ctgtctcttg gatattctcg acacagcagg
361 tcaagaggag tacagtgcaa tgagggacca gtacatgagg actggggagg gctttctttg
421 tgtatttgcc ataaataata ctaaatcatt tgaagatat caccattata gagaacaaat
481 taaaagagtt aaggactctg aagatgtacc tatggtccta gtaggaaata aatgtgattt
541 gccttctaga acagtagaca caaacaggc tcaggactta gcaagaagtt atggaattcc
601 ttttattgaa acatcagcaa agacaagaca gagagtggag gatgcttttt atacattgggt
661 gagggagatc cgacaataca gattgaaaaa aatcagcaaa gaagaaaaa ctcctggctg
721 tgtgaaaatt aaaaaatgca ttataatgta atctgggtgt tgatgatgcc ttctatacat
```

Figure 14 (continued)

781 tagttcgaga aattcgaaaa cataaagaaa agatgagcaa agatggtaaa aagaagaaaa
841 agaagtcaaa gacaaagtgt gtaattatgt aaatacaatt tgtacttttt tcttaaggca
901 tactagtaca agtggtaatt tttgtacatt acactaaatt attagcattt gttttagcat
961 tacctaattt ttttcctgct ccatgcagac tgtagcttt taccttaaat gcttatttta
1021 aatgacagt ggaagttttt ttttcctcta agtgccagta ttcccagagt tttggttttt
1081 gaactagcaa tgcctgtgaa aaagaaactg aatacctaag atttctgtct tggggttttt
1141 ggtgcatgca gttgattact tcttattttt cttaaccaatt gtgaatgttg gtgtgaaaca
1201 aattaatgaa gcttttgaat catccctatt ctgtgtttta tctagtcaca taaatggatt
1261 aattactaat ttcagttgag accttcta at tggtttttac tgaaacattg agggaacaca
1321 aatttatggg cttcctgatg atgattcttc taggcacat gtcctatagt ttgtcatccc
1381 tgatgaatgt aaagttaacac tgttcacaaa ggttttgtct cctttccact gctattagtc
1441 atggtcactc tccccaaa atatatattt ttctataaaa agaaaaaaat ggaaaaaaat
1501 tacaaggcaa tggaaactat tataaggcca tttccttttc acattagata aattactata
1561 aagactccta atagcttttc ctgttaaggc agaccagta tgaaatgggg attattatag

Figure 14 (continued)

1621 caaccatttt ggggctatat ttacatgcta ctaaattttt ataataatg aaaagatttt
1681 aacaagtata aaaattctc ataggaatta aatgtagtct ccctgtgtca gactgctctt
1741 tcatagtata actttaaatc ttttcttcaa cttagtctt tgaagatagt ttaaatctg
1801 cttgtgacat taaaagatta tttgggccag ttatagctta ttaggtgttg aagagaccaa
1861 ggttgcaagg ccaggccctg tgtgaacctt tgagctttca tagagagttt cacagcatgg
1921 actgtgtccc cacggtcatc cagtgttctc atgcattggt tagtcaaaat ggggagggac
1981 tagggcagtt tggatagctc aacaagatac aatctcactc tgtggtggtc ctgctgacaa
2041 atcaagagca ttgcttttctg ttcttaagaa acaaaactct tttttaaaaa ttacttttaa
2101 atattaactc aaaagttgag attttggggt ggtggtgtgc caagacatta attttttttt
2161 taaacaatga agtgaaaaag tttacaatc tctaggtttg gctagttctc ttaacactgg
2221 ttaaatatc attgcataaa cacttttcaa gtctgatcca tatttaataa tgctttaaaa
2281 taaaaataaa acaatcctt ttgataaaatt taaaatgta ctatttttaa aataaatgaa
2341 gtgagatggc atggtgaggt gaaagtatca ctggactagg aagaaggta ctaggttct
2401 agatagggtg cttttaggac tctgatcttg aggacatcac ttactatcca tttcttcattg

Figure 14 (continued)

2461 ttaaaagaag tcatctcaaa ctcttagttt tttttttta caactatgta atttatatc
2521 catttacata aggatacact tatttgtcaa gctcagcaca atctgtaaat ttttaaccta
2581 tgttacacca tcttcagtgc cagtcttggg caaaattgtg caagagggtga agtttatatt
2641 tgaatatcca ttctcgtttt aggactcttc ttccatatta gtgtcatctt gcctccctac
2701 ctccacatg ccccatgact tgatgcagtt ttaatacttg taattcccct aaccataaga
2761 ttactgctg ctgtggatat ctccatgaag ttttcccact ggtcacatc agaaatgccc
2821 tacatcttat ttcttcaggg ctcaagagaa tctgacagat accataaagg gatttgacct
2881 aatcactaat tttcagggtg tggctgatgc ttggaacatc tctttgctgc ccaatccatt
2941 agcgacagta ggatttttca aacctgggtat gaatagacag aaccctatcc agtgggaagga
3001 gaatttaata aagatagtgc tgaaagaatt ccttaggtaa tctataacta ggactactcc
3061 tggtaacagt aatacatctc attgttttag taaccagaaa tcttcatgca atgaaaaata
3121 ctttaattca tgaagcttac ttttttttt ttggtgtcaga gtctcgctct tgtcaccag
3181 gctgggaatgc agtggcgcca tctcagctca ctgcaacctc catctcccag gttcaagcga
3241 ttctcgtgcc tcggcctcct gagtagctgg gattacaggc gtgtgccact acactcaact

Figure 14 (continued)

3301 aattttttgta tttttaggag agacgggggtt tcaccctgtt ggccaggctg gtctcgaact
3361 cctgacctca agtgattcac ccaccttggc ctcataaacc tgttttgcag aactcattta
3421 ttcagcaaat atttattgag tgcctaccag atgccagtca ccgcacaagg cactgggtat
3481 atggtatccc caaacaagag acataatccc ggtcccttagg tagtgctagt gtggtctgta
3541 atatcttact aaggcctttg gtatacgacc cagagataac acgatgcgta ttttagtttt
3601 gcaaagaagg ggtttggtct ctgtgccagc tctataatg ttttgctacg attccactga
3661 aactcttcga tcaagctact ttatgtaaat cacttcatg ttttaaagga ataaacttga
3721 ttatatgtt tttttattg gcataactgt gattctttta ggacaattac tgtacacatt
3781 aagggtgatg tcagatatc atattgacc aaatgtgtaa tattccagtt ttctctgcat
3841 aagtaattaa aataactta aaaattaata gttttatctg ggtacaaaata aacaggtgcc
3901 tgaactagt cacagacaag gaaacttcta tgtaaaaatc actatgatt ctgaattgct
3961 atgtgaaact acagatcttt ggaacactgt ttaggtaggg tgtaaagact tacacagtac
4021 ctcgtttcta cacagagaaa gaaatggcca tacttcagga actgcagtcg ttatgagggg

Figure 14 (continued)

4081 atattttaggc ctcttgaatt tttgatgtag atggggcattt ttttaaggta gtggttaatt
4141 accttttatgt gaacttttgaa tggtttaaca aaagatttgtt ttttgtagag attttaaagg
4201 gggagaattc tagaaataaa tgttaccctaa ttattacagc cttaaagaca aaaatccttg
4261 ttgaagtttt tttaaaaaaa gctaaattac atagacttag gcattaacat gtttgtggaa
4321 gaatatagca gacgtatat gtatcatttg agtgaatgtt cccaagtagg cattctaggc
4381 tctatttaac tgagtcacac tgcataggaa tttagaacct aacttttata ggttatcaaa
4441 actgttgtca ccattgcaca attttgtcct aatatataca tagaaaacttt gtggggcatg
4501 ttaagttaca gtttgcacaa gttcatctca tttgtattcc attgattttt tttttcttct
4561 aaacattttt tcttcaaca gtataaact ttttttaggg gatttttttt tagacagcaa
4621 aaactatctg aagatttcca tttgtcaaaa agtaatgatt tcttgataat tgtgtagtaa
4681 tgtttttttag aaccagcag ttaccttaaa gctgaattta tatttagtaa ctctgtgtt
4741 aatactggat agcatgaatt ctgcattgag aaactgaata gctgtcataa aatgaaactt
4801 tcttttctaaa gaaagatact cacatgagtt cttgaagaat agtcataact agattaaagt
4861 ctgtgtttta gtttaatagt ttgaagtgcc tgtttgggat aatgataggt aatttagatg

Figure 14 (continued)

4921 aatttagggg aaaaaaaaaagt tatctgcaga tatgttgagg gcccatctct cccccacac
4981 cccacagag ctaactgggt tacagtgttt tatccgaaag ttccaattc cactgtcttg
5041 tgttttcatg ttgaaaatac ttttgcattt ttcctttgag tgccaatttc ttactagtac
5101 tatttcttaa tgtaacatgt ttacctggaa tgtattttta ctatttttgt atagtgtaaa
5161 ctgaaacatg cacattttgt acattgtgct ttcttttgtg ggacatatgc agtgtgatcc
5221 agttgttttc catcatttgg ttgcgctgac ctaggaaagt tggtcataac aaacattaaa
5281 aatgaccact cttttaattg aaattaactt ttaaatgttt ataggagtat gtgctgtgaa
5341 gtgatctaaa atttgtaata tttttgtcat gaactgtact actcctaatt attgtaatgt
5401 aataaaaaa gttacagtga caaaaaaaaa aaaaaa

Figure 15

Human KRAS2 isoform b cDNA sequence

```
1  ggccgcggcg gcggaggcag cagcgcgccg gccagtggcg gcggcgaagg tggcgccggc
61  tcggccagta ctccgggcc ccgccatttc ggactgggag cgagcgccgc gcaggcactg
121 aaggcgcgcg cggggccaga ggctcagcgg ctcccagggtg cgggagagag gcctgctgaa
181 aatgactgaa tataaacttg tggtagttgg agctgggtgc gtaggcaaga gtgccttgac
241 gatacagcta attcagaatc atttgtgga cgaatatgat ccaacaatag aggattccta
301 caggaaagcaa gtagtaattg atggagaaac ctgtctcttg gatatctctg acacagcagg
361 tcaagaggag tacagtgcaa tgagggacca gtacatgagg actggggagg gctttctctg
421 tgtatttgcc ataaataata ctaaatcatt tgaagatat caccattata gagaacaaat
481 taaaagagtt aaggactctg aagatgtacc tatggtccta gtaggaaata aatgtgattt
541 gccttctaga acagtagaca caaacaggc tcaggactta gcaagaagtt atggaattcc
601 tttttattgaa acatcagcaa agacaagaca gggtggtgat gatgccttct atacattagt
661 tcgagaaatt cgaaaacata aagaaaagat gagcaaatat ggtaaaaaga agaaaaagaa
721 gtcaaaagaca aagtgtgtaa ttatgtaaat acaatttgta ctttttctt aaggcatact
```

Figure 15 (continued)

781 agtacaagtg gtaatttttg tacattacac taaattatta gcatttgttt tagcattacc
841 taattttttt cctgctccat gcagactgtt agcttttacc ttaaatgctt attttaaaat
901 gacagtggaa gttttttttt cctctaagtg ccagtattcc cagagttttg gtttttgaac
961 tagcaatgcc tgtgaaaaag aaactgaata cctaagattt ctgtcttggg gtttttggtg
1021 catgcagtbg attacttctt atttttctta ccaattgtga atgttggtgt gaaacaaatt
1081 aatgaagcct ttgaatcatc cctattctgt gttttatcta gtcacataaa tggattaat
1141 actaatcca gttgagacct tctaattggt ttttactgaa acatgaggg aacacaaatt
1201 tatgggcttc ctgatgatga ttcttctagg catcatgtcc tatagtttgt catccctgat
1261 gaatgtaaag ttacactgtt cacaaagggt ttgtctcctt tcactgcta ttagtcatgg
1321 tcactctccc caaataatta tatttttctt ataaaaagaa aaaaatggaa aaaaattaca
1381 aggcaatgga aactattata aggccatttc cttttccat tagataaatt actataaaga
1441 ctccataatag cttttccctgt taaggcagac ccagtatgaa atggggatta ttatagcaac
1501 cattttgggg ctatatattac atgctactaa atttttataa taattgaaaa gattttaaca
1561 agtataaaaa attctcatag gaattaaatg tagtctccct gtgtcagact gctctttcat

Figure 15 (continued)

1621 agtataaactt taaatctttt cttcaacttg agtccttgaa gatagtttta attctgcttg
1681 tgacattaaa agattatttg ggcagttat agcttattag gtgttgaaga gaccaaggtt
1741 gcaaggccag gccctgtgtg aacctttgag cttcataga gagtttcaca gcatggactg
1801 tgtccccacg gtcattccagt gttgtcatgc attggttagt caaaatgggg aggactagg
1861 gcagtttgga tagctcaaca agatacaatc tcaactctgtg gtggtcctgc tgacaaatca
1921 agagcattgc ttttgtttct taagaaaaa aactctttt taaaaattac ttttaatat
1981 taactcaaaa gttgagattt tggggtggtg gtgtgccaaag acattaattt tttttttaa
2041 caatgaagtg aaaaagttt acaatctcta ggtttggtta gttctcttaa cactggttaa
2101 attaacattg cataaacact tttcaagtct gatccatatt taataatgct ttaaaataaa
2161 aataaaaaa atccttttga taaattttaa atgttactta ttttaaaaata aatgaagtga
2221 gatggcatgg tgaggtgaaa gtatcactgg actaggaaga aggtgactta ggttcttagat
2281 aggtgtcttt taggactctg attttgagga catcactac tatccatttc ttcatgttaa
2341 aagaagtcat ctcaaaactct tagttttttt tttttacaac tatgtaattt atattccatt
2401 tacataagga tacacttatt tgtcaagctc agcacaatct gtaaaatttt aacctatgtt

Figure 15 (continued)

2461 acaccatctt cagtgccagt cttgggcaaa attgtgcaag aggtgaagtt tatatttgaa
2521 tatccattct cgttttagga ctcttcttcc atattagtgt catcttgctt ccctaccttc
2581 cacatgcccc atgacttgat gcagttttaa tacttgtaat tcccctaacc ataagattta
2641 ctgctgctgt ggatatctcc atgaagtttt cccactgagt cacatcagaa atgccctaca
2701 tcttatttcc tcagggtcga agagaatctg acagatacca taaagggtt tgacctaatc
2761 actaattttc agtggtgggc tgatgctttg aacatctctt tgctgccccaa tccattagcg
2821 acagtaggat ttttcaacc tggtatgaat agacagaacc ctatccagt gaaggagaat
2881 ttaataaaga tagtgctgaa agaattcctt aggtaatcta taactaggac tactcctggt
2941 aacagtaata cattccattg ttttagtaac cagaaatctt catgcaatga aaaatacttt
3001 aattcatgaa gcttactttt tttttttggt gtcagagtct cgctcttgtc acccaggctg
3061 gaatgcagtg gcgccatctc agctcactgc aacctccatc tcccaggttc aagcgattct
3121 cgtgccctcg cctcctgagt agctgggatt acaggcggtg gccactacac tcaactaatt
3181 tttgtatttt taggagagac ggggtttcac cctgttgcc aggtgggtct cgaactcctg
3241 acctcaagt attcaccac ctgggcctca taaacctgtt ttgcagaact catttattca

Figure 15 (continued)

3301 gcaaatattt attgagtgc taccagatgc cagtcaccgc acaaggcact gggatatatgg
3361 tatccccaaa caagagacat aatccccgtc cttaggtagt gctagtgtgg tctgtaatat
3421 cttactaagg cctttgggtat acgaccacga gataacacga tgcgtatttt agttttgcaa
3481 agaaggggtt tggctctctgt gccagctcta taattgtttt gctacgattc cactgaaact
3541 cttcgatcaa gctactttat gtaaatcact tcattgtttt aaaggaataa acttgattat
3601 attgtttttt tatttggcat aactgtgatt cttttaggac aattactgta cacattaagg
3661 tgtatgtcag atattcataat tgacccaaat gtgtaatat ccagttttct ctgcataagt
3721 aattaaaata tacttaaaaa ttaatagttt tatctgggta caaataaaca ggtgcctgaa
3781 ctagttcaca gacaaggaaa cttctatgta aaatcacta tgatttctga attgctatgt
3841 gaaactacag atctttggaa cactgttttag gtagggtgtt aagacttaca cagtacctcg
3901 tttctacaca gaaaagaaa tggccatact tcaggaaactg cagtgcctat gaggggatat
3961 ttaggcctct tgaatttttg atgtagatgg gcattttttt aaggtagtgg ttaattacct
4021 ttatgtgaac tttgaatggt ttaacaaaag atttgttttt gtagagattt taaagggga
4081 gaattctaga aataaatgtt acctaatat tacagcctta aagacaaaaa tccttgttga

Figure 15 (continued)

4141 agttttttta aaaaaagcta aattacatag acttaggcac taacatgttt gtggaagaat
4201 atagcagacg tatattgtat catttgagtg aatgttccca agtaggcatt ctaggctcta
4261 ttttaactgag tcacactgca taggaattta gaacctaaact tttatagggt atcaaaaactg
4321 ttgtcaccat tgcacaattt tgtcctaata tatacataga aactttgtgg ggcattgttaa
4381 gttacagtth gcacaagtth atctcatthg tattccattg attttttttt tcttctaaac
4441 attttttctt caaacagtat ataacttttt ttaggggatt tttttttaga cagcaaaaaac
4501 tatctgaaga tttccatttg tcaaaaaagta atgattttctt gataattgtg tagtaattgtt
4561 ttttagaacc cagcagttac cttaaagctg aattttatat tagtaacttc tgtgttaata
4621 ctggatagca tgaatttctgc attgagaaac tgaatagctg tcataaaaatg aaacttttctt
4681 tctaaagaaa gatactcaca tgagtttcttg aagaatagtc ataactagat taagatctgt
4741 gtttttagttt aatagtttga agtgcctgtt tgggataatg ataggtaatt tagatgaatt
4801 taggggaaaa aaaagttatc tgcagatatg ttgagggccc atctctcccc ccacaccccc
4861 acagagctaa ctgggttaca gtgtttttatc cgaagtttc caattccact gtcttgtgtt
4921 ttcatgttga aaatactttt gcattttttcc tttgagtgc aatttcttac tagtactatt

Figure 15 (continued)

4981 tcttaatgta acatgtttac ctggaatgta ttttaactat ttttgtatag tgtaaaactga
5041 aacatgcaca ttttgtacat tgtgctttct tttgtgggac atatgcagtg tgatccagtt
5101 gttttccatc atttgggtgc gctgacctag gaatgttggt catatcaaac attaaaaatg
5161 accactcttt taattgaaat taacttttaa atgtttatag gagtatgtgc tgtgaagtga
5221 tctaaaaatt gtaatatattt tgtcatgaac tgttactactc ctaattattg taatgtaata
5281 /
5281 aaaatagtta cagtgacaaa aaaaaaaaaa aa

Figure 16

Mouse Kras2 isoform a cDNA sequence (coding region)

atgactgagt ataaacttgt ggtggttgga gctggtggcg taggcaagag cgccttgacg
atacagctaa ttcagaatat ctttgtggat gagtatgacc ctacgataga ggactccttac
aggaaacaag tagtaattga tggagaaaacc tgtctcttgg atattctcga cacagcaggt
caagaggagt acagtgcaat gagggaccag tacatgagaa ctggggaggg ctttctttgt
gtatttgcca taaataatac taaatcattt gaagatatcc accattatag agaacaatt
aaaagagtaa aggactctga agatgtgcct atggtcctgg tagggaataa gtgtgatttg
ccttctagaa cagtagacac gaaacaggct caggagttag caaggagtta cgggattccg
ttcattgaga cctcagcaaa gacaagacag agagtggagg atgcttttta tacattgggtg
agagagatcc gacagtacag attgaaaaaa atcagcaaaag aagaaaaagac tcctggcctgt
gtgaaaaatta aaaaatgcgt tataatgtaa

Figure 17**Mouse Kras2 isoform b cDNA sequence**

```
1  cggacgcgtg ggcggcagcg ctgtggcggc ggctgagacg gcaggggaag gcggcggcgg
61  ctcgggcccg agtcccgcct ccgcgccatt tcggaccccg agcagcgcg gcgcgggcct
121 gaaggcggcg gcgggagcct gaggcgcggc ggctccgcgg cgcggagaga ggcctgctga
181 aaatgactga gtataaactt gtggtggttg gagctggtgg cgtaggcaag agcgccttga
241 cgatacagct aattcagaat cactttgttg atgagtacga ccctacgata gaggactcct
301 acaggaaaca agtagtaatt gatggagaaa cctgtctctt ggatatcttc gacacagcag
361 gtcaagagga gtacagtgca atgagggacc agtacatgag aactggggag ggctttcttt
421 gtgtatttc cataaataat actaaatcat ttgaagatat tcaccattat agagaacaaa
481 ttaaaagagt aaaggactct gaagatgtgc ctatggtcct ggtagggaat aagtgtgatt
541 tgccttctag aacagtagac acgaaacagg ctcaggagtt agcaaggagt tacgggattc
601 cgttcattga gacctcagca aagacaagac aggggtgttg cgatgccttc tatacattag
661 tccgagaaat tcgaaaaacat aaagaaaaaga tgagcaaaaga tgggaagaag aagaagaaga
721 agtcaaggac aagggtgtaca gttatgtgaa tactttgtac tctttcttaa ggcacactta
```

Figure 17 (continued)

781 agtaaaagtg tgatttttgt acattacact aaattattag catttgtttt agcattacct
841 aatctttttt ttttcttctg ttcgtgcaaa ctgtcagctt ttatctcaaa tgcttatttt
901 aaaagaacag tggaacacct cttttttcta agtgccagta ttccctgggt ttgggactta
961 aactagcaat gcctgtggaa gagactaaag acctgagact ctgtcttggg atttggtgca
1021 tgcagttgat tccttgctag ttctcttacc aactgtgaac actgatggga agcaggataa
1081 tgaagcttcc ggaccatccc tgctctgtgt ccctctactc atccaatgga gtcattagca
1141 gtcaatcgca gcttcactgg aactgaggg gtcacagact taggtccct ttgagtcacg
1201 tccagcgtgt cctagacttt atcatcttc agaggcgtag gcagactgtt caaaaaggct
1261 ttctctagct ttccactgca attaatcttg gtactccct caaatagtat atttttcta
1321 gaaaagggga aaaatggaaa aaaaaaaaaa ggcaatggaa aatgttgaaa tccattcagt
1381 ttccatgtta gctaaattac tgtaagattc ctataatagc tttcctggt aaggcagacc
1441 cagtatgaaa tagtaataac catttgggct atatttacct gctactaaat ttttgtaata
1501 attcaaacaa ctttagcata tataaaaagt tctcataaga attaatgata aaaaaaaaaa
1561 aaaaaaa

Figure 18**Mouse Ak016641 cDNA sequence**

```
1 acacagactg ggggaggtgg gattcttcgc ccatagagag aggcattgaa tacgtcgact
61 ctgacatttc tcgtgagaat ggtctttcta gtaccagtgt agcaaaggaa tcataaaatt
121 tgataaaactg aagacagttg gattagcagg gaagagaaga ggcacctcct ctgccagcca
181 tgatgaagga agcatcggag cctctagcca gtgtcaccag catcaataag caagacagta
241 aagtacagga tggagagata agaaaagaaa aaattggaac catcactcca tcgaaaacagc
301 attcttcagt ccacttcttc ccaaagataa tggattcaga ctccaccacg ctcatcccgt
361 tgtcccgcctc attttccaa gaaatgccaa ttggcttcta ccagatcacc agcaccacga
421 acagctccac ctatcgtcc agaggacagc tggcttctaa atccaccatc ctgagctgct
481 cccacaaaaga cagcagcctg ggaaagcaga gcaccagctc catggttcca cggaggcagc
541 cccagtcgag ctctgacgtg gatacgtata cttttgggaa tggtgaggat tatttccttt
601 cttttgtttgg agaatcgaag aagctcaccg ccacacacc ccaagccgag aacgtgagcg
661 aacacctttc tgtgatacctt gaggaagtcg gccaatctac atccagttct ctggagaaa
721 ttaaaatagc tgaggtaaat atcaagggcc tctttgtgag gcttgtcaac tcctccaatg
```

Figure 18 (continued)

781 aaaaggaagt agagattgga aaccacattc ttcagcaaaa cgtgaatgga cagcagtcct
841 ccttgtacca gtccccgac aacatcacac tgcaggccaa ctccacggtg acagtgtggg
901 cagcagcttc ggaagcaaaag ccacagccac caacggactt tgtttgggag gaacagagca
961 agttccgac cagtccggac tgcacgacca tcttgtgcaa gcccaatggt gaggccattg
1021 cctgggtacac tcctatccac tggaagcaag cctgggagaa gttagagact gacattgaat
1081 tcgaaagatg ctcagtgggt gtcccatcaa tgagaaaacca catgtttgga tggataacag
1141 catctgtctc ttccacaaac gaggagaaaag aagaaccaat acagaaaaacg ccctcccaag
1201 tctaccctgt cctctacaga gaaaaggaaa tcccgccaac tgtcttacct aataagagcc
1261 cctggtgccg caatcccaac acttctccac atccgtacag ctctctgatt gactcacatg
1321 actcggacat ttccgaaagc agtttagata cacagctcaa gcctcagcca accaagccca
1381 aaccagaccc agggaccaag aaaaagaaaag caaagtcata agaaaatgga aagccatgaa
1441 atctgtgaac gtgagtaact attgtagagt tgctttataa caaaatatc cacaataaat
1501 tgcaataaat ttttgagggt ctcgctttat gacc

Figure 19**Mouse Ak015530 CDNA sequence**

```
1 gggccgtggt gccgcaagc gctggagtga ggcggtctga gcaagctgtc gtctggaccc
61 cagacctgct ggtggtgaag tataatcatgt ataaagtgg atcaattcca tgttaagtga
121 aaatggccaa ttcgttacga ggagaagtac tgactcttta taaaaatctg ctgtatcttg
181 gacgggacta tccaaaagga gcagactatt ttaaaggcg tttgaagaac gtttccctta
241 aaaacaagga tgtggaggac ccagagaaga tcaaaagaact tatcgacga ggagaatttg
301 taatgaagga gctagaggcc ttgtacttcc ttaggaaata cagagctatg aagcaacggt
361 actattcaga taccaaagtc tgaccaatca ttgcaccagt cgagctgaca accagtgcgtg
421 gctgtttgcc tgtaccaact attaaaaaat aattcagttt aaaagggtga gatacatggt
481 ttttaaaaaa atgagttgcc ctactgtact gaaatagggt tcaaccttat tgatactgag
541 agctttgccc ataatccttt tattactgaa atagtaactt tagtaccttt catgataata
601 taattttgaa agaaaataca cttaattttt aaacatgtta tagccaattt tcttaagtct
661 atttcttcat ttactgatga gattgtcact atcgaatggt gtctgacagg cttggcccttt
721 agcttctaga gtgtctttgt ccttggtttt tggtgttttg ttagcccatc tagtatacta
```

Figure 19 (continued)

781 aagtgcata tcaaggctct ctacagacac ctcaaatga tttaaatgca gttatcaaaa
841 taagacatgt gaagtgacc tctatcttga gaagctcagt gggtgactag cattgtgtag
901 ctattattcc cattattctt tgtgctgctg gcctgcctta agttctgaac cacttcaagt
961 agctttcatg aggagttgta atgttcctct atttctgcc ttaaagctgg tataatttct
1021 gtcgacctgt aaccgagtcc atgtggcagt ggacctaac caggcaggac tgtaagttta
1081 agcaaaaaatg tttatgtaat gtttttagca acgttataaa taacatttct aacttaaaag
1141 ctgcaaatag tgttgcttat aggattctgt atcaggctgg agagatggct cagtggttaa
1201 gagcactgac tgctcttcca gaggtcctga atttaattcc cagcaaccat atggtggtt
1261 acaaccatct gtaatgggat ctgatgtcca cttctggtgt gtctgaacac agacagtgt
1321 ctcatagaat aaataaataa acgaataaat ctt